CLAIMS

1. A separator for a fuel cell comprising: a corrugated or undulated gas flow path portion formed on central portion of a clad thin plate; and

a flat portion formed on an outer periphery of the central portion, wherein

the clad thin portion is obtained by applying rolling work on a metal plate whose surface is covered with a precious metal layer at a draft of 5% to 15% to make clad,

a limit plate thickness residual rate (a value obtained by dividing a plate thickness of the clad thin plate after working by an original plate thickness thereof) indicating a boundary limit in which cracking of the precious metal layer in the clad thin plate and reduction of corrosion resistance due to exposure of the metal plate are negligible is obtained in advance, wherein

regarding a sectional shape in a direction orthogonal to a flow path of the gas flow path portion , when a plate thickness of a rib central portion contacting with a gas diffusion layer is represented as t1, a plate thickness of the thinnest portion of a rib shoulder portion is represented as t2, a plate thickness of a rib slope portion is represented as t3, and a plate thickness of a peripheral portion of the separator is represented as t4, a relationship of $t2 \geq t4 \times$limit plate thickness residual rate is satisfied.

2. The separator for a fuel cell according to claim 1, wherein the limit plate thickness residual rate is a limit value at which lowering of corrosion resistance due to cracks of the precious metal layer of the clad thin plate and exposure of the metal plate is negligible, which can be obtained by, regarding a sample obtained by applying plane strain to the clad thin plate to apply stepwise plane plastic strains to the clad thin plate, measuring respective plate thickness residual rates in respective steps, observing presence/absence of fine cracks in the precious metal layer and exposure of the metal plate, and measuring a

corrosion resistance deterioration ratio.

3. The separator for a fuel cell according to claim 1 or 2, wherein when the draft at the time of the rolling work for making clad is x [%] and the limit plate thickness residual rate is y, a relationship of $y=0.5+0.02x$ is satisfied.

4. The separator for a fuel cell according to any one of claims 1 to 3, further satisfying a relationship of $t2 \geq t4 \times 0.7$.

5. The separator for a fuel cell according to any one of claims 1 to 4, wherein when an outside corner portion radius of curvature in the vicinity of a measurement position on the side of the sectional shape of the gas flow path portion contacting with the gas diffusion layer is Rout and a corner portion radius of curvature of a portion of an inside corner portion whose radius of curvature is the smallest on the side of a back face thereof is Rin,

a relationship where Rout is positive (Rout portion is a convex curvature), Rout/(Rin+t2) is 5 or less, Rout/t2 is 10 or less, and Rout/Rin is 10 or less is satisfied.

6. The separator for a fuel cell according to any one of claims 1 to 5, wherein Rout is 0.6mm or less.

7. The separator for a fuel cell according to any one of claims 1 to 6, further satisfying a relationship of $t2/t3 \geq 0.75$ and $t3 \geq t1$.

8. The separator for a fuel cell according to claim 1 or 2, wherein the metal plate is one type of alloy selected from a group consisting of iron-base alloy, Ni-base alloy, industrial pure Ti, and Ti-base alloy and an alloy of a combination of at least two alloys selected therefrom.

9. The separator for a fuel cell according to any one of claims 1, 2 and 8, wherein the metal plate is austenite-base stainless steel or ferrite-base stainless steel.

10. The separator for a fuel cell according to any one of claims 1, 2 and 9, wherein the precious metal layer is made from Au or Au alloy.

11. The separator for a fuel cell according to any one of claims 1, 2 and 10,

wherein the plate thickness t4 of the clad thin plate is in a range of 0.05mm to 0.1mm, the thickness of the precious metal layer is in a range of 0.01μm to 0.05μm, and the thickness of the precious metal layer is 1/10000 to 1/1000 of the thickness of the clad thin plate.

12. The separator for a fuel cell according to any one of claims 1 to 11, wherein, on a surface of the rib shoulder portion of the sectional shape and the portion with the plate thickness t2, the precious metal layer is not cracked so that the metal plate as the underlying base member is not exposed, or even if the precious metal layer is cracked so that the metal plate as the underlying base member is exposed, an area ratio of the exposed metal plate to the whole area of the metal plate is 1% or less.

13. A fuel cell stack, comprising a membrane electrode joined body formed on both surfaces of an electrolytic membrane with an oxidizing agent electrode and a fuel electrode, an oxidizing agent electrode side separator disposed on the side of the oxidizing agent electrode of the membrane electrode joined body, and a fuel electrode side separator disposed on the side of the fuel electrode of the membrane electrode joined body, in which a plurality of unit cells formed with an fuel gas flow path and an oxidizing gas flow path between the membrane electrode joined body and the respective separators are stacked, and a cooling water flow path is formed between the respective unit cells, wherein each of the oxidizing agent electrode side separator and the fuel electrode side separator is the separator for a fuel cell according to any one of claims 1 to 11.

14. A fuel cell vehicle which is mounted with the fuel cell stack according to claim 13 and uses the fuel cell stack as power source.

15. A method for manufacturing a separator for a fuel cell comprising:

preliminary press forming a clad thin plate obtained by forming a precious metal layer on a surface of a metal plate to perform rolling work on the metal plate at a draft of 5% to 15% to make clad to elongate the clad thin plate;

and

finishing press forming the clad thin plate in a predetermined corrugated shape to form a gas flow path portion.

16. The method for manufacturing a separator for a fuel cell according to claim 15, wherein the finishing press forming step is for performing bending work on the clad thin plate to constitute a gas flow path groove with a corrugated shape, and applying a compression stress in a direction orthogonal to the gas flow path groove in a plane direction of the clad thin plate at a time of the bending work.

17. The method for manufacturing a separator for a fuel cell according to claim 15, wherein the preliminary press forming is for elongating the clad thin plate to conduct press forming such that a formation height of the clad thin plate after the preliminary press forming is at least 1.25 times a formation height of a product.